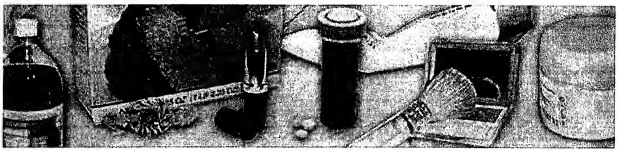


WHAT IS GLYCERIN?

Glycerin, sometimes spelled glycerine, is a commercial product whose principal component is glycerol. The terms glycerin, glycerine, and glycerol are often used interchangeably in the literature.

Glycerin is one of the most versatile and valuable chemical substances known to man. It possesses a unique combination of physical and chemical properties that are utilized in myriad products. Glycerin has over 1,500 known end uses, including many applications as an ingredient or processing aid in cosmetics, toiletries, personal care, drugs, and food products. In addition, glycerin is highly stable under typical storage conditions, compatible with many other chemical materials, virtually non-toxic and non-irritating in its varied uses, and has no known negative environmental effects. A water clear, odorless, viscous liquid with a sweet taste, glycerin is derived from both natural and petrochemical feedstocks. It occurs in combined form (triglycerides) in all animal fats and vegetable oils and constitutes, on average, about 10 percent of these materials. Glycerin is obtained from fats and oils during soap and fatty acid production and by transesterification (an interchange of fatty acid groups with another alcohol). It is subsequently concentrated and purified prior to commercial sale. Synthetic glycerin is produced from petrochemical building blocks via several processing steps designed to achieve the desired concentration and high product quality. Glycerin, whether recovered from triglycerides or synthesized, is principally used as a highly refined and purified product, with a very high concentration of glycerol.

Glycerol, the main component of glycerin, has the chemical formula C 3 H 5 (OH)3 . It is a trihydric alcohol, possessing two primary and one secondary hydroxyl groups, which are its potential reaction sites and the basis for glycerin's versatility as a chemical raw material. For example, glycerol esters, the reaction products of glycerin with various fatty acids form an important class of derivatives that are extensively used in the food industry. The physical properties and characteristics of glycerin are as significant as its chemical properties for many applications. These qualities enable glycerin to be used as a humectant, plasticizer, emollient, thickener, solvent, dispersing medium, lubricant, sweetener, bodying agent, antifreeze and processing aid. It is not unusual for glycerin to contribute two or more features or attributes to a product or application. In all applications, whether as a reactant or as an additive, the virtual non-toxicity and overall safety of glycerin is always of significant benefit. Glycerin applications appear to be limited only by the imagination and creativity of the scientific and

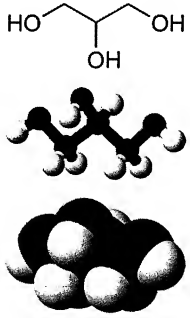
technical communities.

Most of the glycerin marketed today is manufactured to meet the stringent requirements of the United States Pharmacopeia (USP) and the Food Chemicals Codex (FCC). However, technical grades of glycerin that are not certified as USP or FCC are available. Glycerin is used in many consumer products such as personal care preparations, cosmetics, pharmaceuticals and foods because of its contribution to product properties, stability and compatibility with a wide variety of chemicals, and relative non-toxicity. For these consumer-oriented applications, the quality and purity of the ingredients is crucially important. The use of USP and FCC- certified glycerin, versus technical grade glycerin, in consumer product applications ensures that the manufacturer has specified the glycerin quality and consistency required for these products.

Next: WHAT DOES USP MEAN?

Glycerol

From Wikipedia, the free encyclopedia

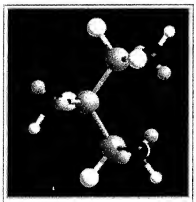
Glycerol	
	
Chemical name	Propane-1,2,3-triol
Other names	glycerin glycerine propane-1,2,3-triol 1,2,3-propanetriol 1,2,3-trihydroxypropane glyceritol glycyl alcohol
Chemical formula	$C_3H_5(OH)_3$
Molecular mass	92.09382 g/mol
CAS number	[56-81-5 (http://www.nlm.nih.gov/cgi/mesh/2006/MB_cgi?term=56-81-5&rn=1)]
HS number	Crude: 1520.00.00 Pure: 2905.45.00
Density	1.261 g/cm³
Viscosity	1.5 Pa.s
Melting point	18 °C (64.4°F)
Boiling point	290 °C (554°F)
Food energy	4.32 kcal/g
SMILES	OCC(O)CO
Flash Point	160 °C (closed cup)
Supplementary data page	
Structure & properties	n, ε_r, etc.
Thermodynamic data	Phase behavior Solid, liquid, gas
Spectral data	UV, IR, NMR, MS

Disclaimer and references

Glycerol is a chemical compound with the formula $HOCH_2CH(OH)CH_2OH$. This colorless, odorless, viscous liquid is widely used in pharmaceutical formulations. Also commonly called **glycerin** or **glycerine**, it is a sugar alcohol and fittingly is sweet-tasting and of low toxicity. Glycerol has three hydrophilic alcoholic hydroxyl groups that are responsible for its solubility in water and its hygroscopic nature. Its surface tension is 64.00 mN/m at 20 °C and it has a temperature coefficient of -0.0598 mN/(m K). It is a central component of lipids.

Contents

Synthesis



Glycerol (3D model), showing the atoms and the lone electron pairs associated with the oxygen atoms (in pink)

Since glycerol forms the backbone of triglycerides, it is produced on saponification or transesterification. Soap making and biodiesel production are examples of the former and latter. Until recently, synthetic glycerol was mainly manufactured at an industrial scale from epichlorohydrin though this process is no longer economical. Glycerol is a 10% by-product of biodiesel manufacture (via the transesterification of vegetable oils). This has led to a glut of crude glycerol on the market. Although this crude glycerol (typically containing 20% water and residual esterification catalyst) can be refined to a purified form, a great deal of research is being conducted to try to make value-added molecules from glycerol, as an alternative to incineration. One such programme to add value to this glut of glycerol is the UK-based initiative The Glycerol Challenge (http://www.theglycerolchallenge.org/). Some potential uses for glycerol include the following:

- Hydrogen gas production

- Glycerine acetate (potential fuel additive)[1]
- Compost additive
- Citric acid production
- Conversion to propylene glycol[2][3].
- Conversion to acrolein[4][5]
- Conversion to ethanol[6]
- Conversion to epichlorhydrin[7]. Epichlorhydrin is a raw material for epoxy resins.

Metabolism

Glycerol is a precursor for synthesis of triacylglycerols and of phospholipids in the liver and adipose tissue. When the body uses stored fat as a source of energy, glycerol and fatty acids are released into the bloodstream. The glycerol component can be converted to glucose by the liver and provides energy for cellular metabolism.

Before glycerol can enter the pathway of glycolysis or gluconeogenesis (depending on physiological conditions), it must be converted to their intermediate glyceraldehyde 3-phosphate in the following steps:

	glycerol kinase	glycerol 3-P dehydrogenase	triose P isomerase	
glycerol	----------→	glycerol 3-P	←----------→	DHAP ←----------→ glyceraldehyde 3-P

The enzyme glycerol kinase is present only in the liver. In adipose tissue, glycerol 3-phosphate is obtained from dihydroxyacetone phosphate (DHAP) with the enzyme glycerol 3-phophate dehydrogenase.

Applications

Medicine and pharmaceutical technology

- Used in medical and pharmaceutical preparations, mainly as a means of improving smoothness, providing lubrication and as a humectant. Also may be used to lower intracranial and intraocular pressures.
- Used at 10% to prevent tannins from precipitating in ethanol extracts of plants (tinctures).
- Used as a substitute for alcohol, as a solvent that will create a therapeutic herbal extraction, but is less extractive and is approximately 30% less able to be absorbed by the body. Fluid extract manufacturers often extract herbs in hot water before adding glycerin to make glycerites.[8]

[9][10]

- Used as a prochiral building block in organic synthesis.
- Used as a laxative when introduced into the rectum in suppository or liquid (enema) form; irritates the bowel and induces a hyperosmotic effect.
- Cough syrups, elixirs and expectorants.

Personal care

- Serves as an emollient, humectant, solvent, and lubricant in personal care products.
- Competes with sorbitol although glycerol has better taste and higher solubility.
- Toothpaste, mouthwashes, skin care products, shaving cream, hair care products and soaps

> Glycerol is a component of glycerol soap, which is made from denatured alcohol, glycerol, sodium castorate (from castor), sodium cocoate, sodium tallowate, sucrose, water and parfum (fragrance). Sometimes one adds sodium laureth sulfate. This kind of soap is used by people with sensitive, easily irritated skin because it prevents skin dryness with its moisturizing properties. It is possible to make glycerol soap at home.

It was once believed that when used as an emollient, glycerol should never be applied undiluted to the skin. It was thought that the same powerful hygroscopic property that draws moisture out of the air to moisten the skin will draw moisture out of the skin if the glycerol is too concentrated. This in fact has proven to be untrue.

Foods and beverages

- Serves as humectant, solvent and sweetener, may help preserve foods.
- Solvent for flavors (such as vanilla) and food coloring.
- Humectant and softening agent in candy, cakes and casings for meats and cheeses.
- Manufacture of mono- and di-glycerides for use as emulsifiers
- Used in manufacture of polyglycerol esters going into shortenings and margarine.
- Used as filler in low-fat food products (i.e., cookies).
- Used as thickening agent in liqueurs.
- Produced when butter becomes rancid.

Glycerol has approximately 27 calories per teaspoon and is 60% as sweet as sucrose. Although it has about the same food energy as table sugar, it does not raise blood sugar levels, nor does it feed the bacteria that form plaques and cause dental cavities. Glycerol should not be consumed undiluted, as unhydrated glycerol will draw water from tissues, causing blistering in the mouth and gastric distress. As food additive, glycerol is also known as E number E422.

Feed

Glycerol is increasingly used in feeding animals.

Polyether polyols

- One of the major raw materials for the manufacture of polyols for flexible foams, and to a lesser extent rigid polyurethane foams
- Glycerol is the initiator to which propylene oxide/ethylene oxide is added

Alkyd resins (plastics) and cellophane

- Used in surface coatings and paints
- Used as a softener and plasticizer to impart flexibility, pliability and toughness
- Uses include meat casings, collagen casings (medical applications)and nonmeat packaging
- Plasticizer in cellophane.

Absolute alcohol

- There is an absolute alcohol production process by dehydration using glycerol.

Other applications

- Manufacture of paper as a plasticizer, Nitroglycerin, humectant and lubricant. Nitroglycerin is an essential ingredient of smokeless gunpower and various munitions. Reliance on soap making to supply co-product glycerine made it difficult to increase production to meet wartime demand. Hence, synthetic glycerin processes were national defense priorities in the days leading up to World War II.
- Used in lubricating, sizing and softening of yarn and fabric
- Used in de-/anti-icing fluids, as in vitrification of blood cells for storage in liquid nitrogen
- Patent applications have been filed for detergent softeners and surfactants based on glycerol (i.e., alkyl glyceryl ethers) instead of quaternary ammonium compounds.
- A way to preserve leaves is to submerge them in a solution of glycerol and water.

  > Use a mixture of one part glycerol to two parts water. Place the mixture in a flat pan, and totally submerge the leaves in a single layer in the liquid. You'll have to weigh them down to keep them submerged. In two to six days, they should have absorbed the liquid and be soft and pliable. Remove them from the pan and wipe off all the liquid with a soft cloth. Done correctly, the leaves will remain soft and pliable indefinitely.

- Often used in the preparation of lichen for use in model scenery and dioramas
- Can be added to solutions of water and soap to increase that solution's ability to generate soap bubbles that will last a long time.
- Used as an antifreeze or a cryoprotectant in cryogenic process.
- Used in fog machine fluids
- Used in hookah tobacco mixtures (called "ma'assel" or "shisha" tobacco), often along with molasses and/or honey.
- Counteracts phenol burns
- Now that biodiesel production likely will produce large quantities of co-product glycerine (about 0.1 lb of glycerine per lb of biodiesel), processes are being announced to manufacture propylene glycol and epichlorohydrin, traditionally propylene derivatives, from glycerine.
- A process has been announced to produce ethanol through the metabolic action of E. coli[11].
- Used by some endurance athletes to counteract dehydration by "glycerol loading" before an event.
- Used to preserve bacteria at -80 (prevents lysing of cells).
- Used to increase the density of samples in gel electrophoresis, making them settle in the wells more efficiently.
- Used in PCR as an additive. It decreases the dielectric constant of the mixture, which will weaken hydrogen bonds in the double-stranded DNA and lower the annealing temperature.
- When mixed with potassium permanganate, iron oxide, and aluminum, it produces a thermite reaction.
- Used in the conservation of waterlogged organic objects (such as leather and wood) to stabilise before freeze-drying treatment.

Danger of contamination with diethylene glycol

On May 4, 2007, the US Food and Drug Administration advised all US makers of medicines to test all

batches of glycerine for the toxic diethylene glycol.[12] This follows an occurrence of 100 fatal poisonings in Panama resulting from a Chinese factory deliberately falsifying records in order to export the cheaper diethylene glycol as the more expensive glycerol.[13] Glycerine and diethylene glycol are similar in appearance, smell, and taste. The US Federal Food, Drug, and Cosmetic Act was passed following the 1937 "Elixir Sulfanilamide" incident of poisoning caused by diethylene glycol contamination of medicine.

See also

- Oleochemicals

References

- Health.gov dietary guidelines (http://www.health.gov/dietaryguidelines/dga2005/report/HTML/G1_Glossary.htm)

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9. ^ David Winston www.herbaltherapeutics.com
10. ^ http://www.newhope.com/nutritionsciencenews/NSN_backs/Apr_99/backtalk.cfm
11. ^ http://www.sciencedaily.com/releases/2007/06/070626115246.htm
12. ^ U.S. Food and Drug Administration. "FDA Advises Manufacturers to Test Glycerin for Possible Contamination." (http://www.fda.gov/bbs/topics/NEWS/2007/NEW01628.html) Released May 4, 2007. Last retrieved May 8, 2007.
13. ^ WALT BOGDANICH and JAKE HOOKER. "From China to Panama, a Trail of Poisoned Medicine." (http://www.nytimes.com/2007/05/06/world/06poison.html) New York Times. Published: May 6, 2007. Last retrieved May 8, 2007.

External links

- Glycerol on BioChemInfo.org (http://www.biocheminfo.org/klotho/html/glycerol.html)
- Absolute alcohol using glycerol (http://journeytoforever.org/biofuel_library/Mariller.html)
- Computational Chemistry Wiki (http://www.compchemwiki.org/index.php?title=Glycerol)

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